

Introduction

This water quality monitoring fact sheet was prepared by the Irrigated Agriculture Program of the Central Coast Regional Water Quality Control Board (Water Board) and made available on November 30, 2008. The data were delivered by Central Coast Water Quality Preservation, Inc. (CCWQP) to the Water Board as part of the monitoring and reporting requirements for all dischargers enrolled under *Conditional Waiver of Waste Discharge Requirements for Discharge from Irrigated Lands, Order No. R3-2004-0117*. Monitoring stations were selected to represent water quality in predominantly agricultural areas, but in some cases reflect mixed land uses upstream of the sites.

309MER Merrit Ditch upstream from Highway 183

The Cooperative Monitoring Program sampled Merrit Ditch 37 times (one sample per month) between January 2005 and December 2007, with an additional sample in February 2005.

Summary of Water Quality Data

Notable Measured Analytes for Water Quality Monitoring

Analyte/Parameter	Average	Range	Water Quality Criteria (WQC) or Guideline ¹	Percent Outside WQC or Guideline
Ammonia as N, Unionized	0.025 mg/L	0.001–0.319 mg/L	<0.025 mg/L ⁺	17%
Nitrate/Nitrite as N	19.5 mg/L	3.5–64.8 mg/L	<10.0 mg/L*	77%
Orthophosphate as P	0.24 mg/L	0.00–0.60 mg/L	<0.12 mg/L*	83%
Turbidity (NTU)	198 NTU	9–979 NTU	<25 NTU*	89%
Conductivity	2.02 mmho/cm	0.62–4.18 mmho/cm	Ranges* <0.75 No Problem 0.75–3.0 Increasing >3.0 Severe	% in Range: 3% 86% 11%
pH	8.1	7.4–9.1	7.0–8.5 ⁺	11%
Annual Median Dissolved Oxygen (% Saturation)	2005: 83% 2006: 64% 2007: 95%	43–203%	>85% annual median ⁺	Std not met Std not met Std met
Dissolved Oxygen	9.0 mg/L	3.9–19.5 mg/L	>5.0 mg/L (GEN/WARM) ⁺ >7.0 mg/L (COLD/SPWN)*	8% 27%
Chlorophyll a	6.7 µg/L	0.6–36.1 µg/L	<40 µg/L*	0%
Water Temperature	16.0°C	8.8–25.7°C	Water Basin Specific	--

+ Indicates standard defined in the Water Quality Control Plan, Central Coast Basin (Basin Plan)

* Indicates guideline not described in the Basin Plan or not specifically stated as applicable to the beneficial uses of the site. Origin of the guideline is described in the individual discussion of the analyte/parameter.

The present and potential beneficial uses for **Merrit Ditch** are not specified in the Basin Plan. General Basin Plan water quality objectives will apply. Any analytes not specified under the general objectives in the Basin Plan are compared to a different water quality guideline to create a better understanding of the site's condition.

Unionized Ammonia (as N)

Unionized ammonia (as N) is a calculated value based on water temperature, pH, and total ammonium concentration. Ammonia can be toxic in water. With high water temperature and/or high pH, ammonia becomes unionized and is toxic at

¹ Water Quality Criteria (WQC) are defined in the Water Quality Control Plan, Central Coast Basin (also referred to as the "Basin Plan") to protect beneficial uses such as drinking water, fish habitat, irrigation water, etc. WQC include general water quality standards for some analytes as well as specific criteria based on the defined beneficial uses. Other water quality guidelines were compiled to provide a standard in order to compare sites. Bold indicates beneficial uses that apply to this watershed.

much lower levels. The Basin Plan general water quality objectives state that unionized ammonia shall not exceed 0.025 mg/L. Over time, ammonia should reduce to nitrate, so long-lasting levels of ammonia may indicate continuous discharges of waste. **Six of 36 samples (17%) exceeded the standard. All exceedances occurred as spikes, appearing every six to eight months. The two highest exceedances both occurred in April. The average unionized ammonia concentration was 0.025 mg/L.**

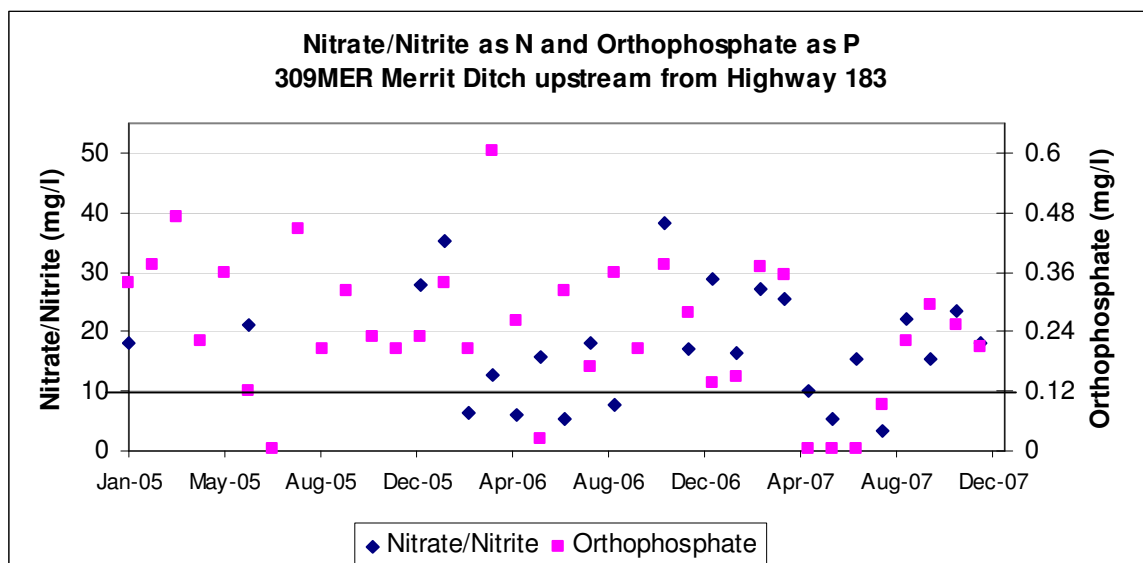
Nitrate/Nitrite as N

The Municipal and Domestic Supply (MUN) objective states in Table 3-2 of the Basin Plan that nitrate as NO_3 shall not exceed 45 mg/L. This value is equivalent to 10 mg/L of nitrate as N. Nitrite accounts for a small percent of total nitrate/nitrite, and therefore, nitrate as N criterion was used as a guideline for nitrate/nitrite. **Twenty of 26 nitrate/nitrite samples (77%) exceeded the guideline. All samples exceeded each year between October and February, and reached as high as 64.8 mg/L (October 2006).**

Orthophosphate as P

The Basin Plan does not contain orthophosphate standards. The Central Coast Ambient Monitoring program (CCAMP) non-regulatory guideline for general water quality objectives states that orthophosphate concentrations shall not exceed 0.12 mg/L. **Orthophosphate concentrations exceeded the guideline in 30 of 36 samples (83%). The average concentration between February and April was 0.34 mg/L, compared to 0.21 mg/L during the remaining months. Orthophosphate reached concentrations as high as 0.60 mg/L (five times the guideline) (April 2006). The average concentration was 0.24 mg/L.**

The chart below shows the nitrate/nitrite and orthophosphate concentrations throughout the sampling period. The guidelines for nitrate/nitrite as N and orthophosphate as P state that their concentrations shall not exceed 10 mg/L and 0.12 mg/L, respectively, shown by the black horizontal line on the graph.



Turbidity

The Basin Plan states: “Water shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.” Sigler et al.² shows that turbidity levels of 25 NTU or greater caused reduction in juvenile salmonid growth due to interference with their ability to find food. Turbidity is often affected by suspended material in runoff. **Thirty-three of 37 turbidity readings (89%) exceeded the guideline. Turbidity levels in Merrit Ditch averaged 198 NTU. No samples between June and October exceeded 110 NTU, while 13 of 17 samples between December and May exceeded 110 NTU. This may indicate an annual cycle.**

² Sigler, J.W., T.C. Bjornn, & F.H. Everst. (1984). *Effects of chronic turbidity on density and growth of steelhead and coho salmon*. Transactions of the American Fisheries Society. 113:142-150.

Conductivity

Conductivity is measured from a water sample. Based on Table 3-3 of the Basin Plan showing Guidelines for Interpretation of Quality of Water for Irrigation, conductivity below 0.75 mmho/cm causes no problems to irrigation, between 0.75 and 3 mmho/cm causes increasing problems, and conductivity above 3 mmho/cm causes severe problems. The conductivity level can be greatly affected by geologic and biological influences and is not necessarily related to agricultural activities. **Measuring conductivity in Merrit Ditch would misrepresent its health. Conductivity and salinity fluctuate daily based on the tides; Merrit Ditch is greatly influenced by the ocean and therefore shows greater salinity. However, one of 37 conductivity samples (3%) indicated no problems to irrigation water; 32 samples (86%) indicated increasing problems; four samples (11%) indicated severe problems. There are no apparent cycles.**

pH

Multiple beneficial uses have objectives for pH. The Basin Plan general water quality objective for pH is between 7.0 and 8.5; MUN, AGR, REC-1, and REC-2 pH objectives are between 6.5 and 8.3. The standard, therefore, is 7.0-8.3 if one or more of MUN, AGR, REC-1, and REC-2 is defined as a beneficial use. pH above 9 can cause skin irritation to humans and makes water inhospitable to many species. **Nine of 37 pH samples (24%) exceeded the MUN, AGR, REC-1, REC-2 standard for pH, and four pH samples (11%) exceeded the GEN standard for pH. The pH levels averaged 8.1, and ranged from 7.4 to 9.1. The annual maximum pH occurred in May or June of each year while the annual minimum occurred between November and February of each year.**

Dissolved Oxygen Concentration and Dissolved Oxygen Saturation

The Basin Plan general water quality objectives state annual median dissolved oxygen shall remain above 85% saturation. General and WARM objectives state that the dissolved oxygen concentration must remain above 5.0 mg/L at all times, and SPWN and COLD objectives state that the dissolved oxygen concentration must remain above 7.0 mg/L at all times. **Three of 37 samples (8%) did not meet the general and WARM concentration standard, and 10 samples (27%) did not meet the COLD and SPWN concentration standard (possibly not applicable). Dissolved oxygen did not meet the saturation standard during 2005 or 2006, with median annual values of 83 and 64% saturation, respectively. The median annual value for 2007 (95%) met the standard for dissolved oxygen saturation.**

Though no standards have been set in the Basin Plan regarding dissolved oxygen supersaturation (>100%), studies have shown that supersaturation of gases may cause gas bubble trauma in fish³. Dissolved gas saturation levels were not collected at this site; however, oxygen levels reached 203% saturation, which may indicate dissolved gas supersaturation.

Chlorophyll a

Healthy and appropriate Chlorophyll a levels are not defined in the Basin Plan. Chlorophyll a indicates phytoplankton growth, a necessary component of healthy water bodies. Because turbidity causes interference for the Chlorophyll a probe, measurements of Chlorophyll a may not be accurate when turbidity is above 1000 NTU. Chlorophyll a levels over 40 µg/L are considered problematic by North Carolina Administrative Code (NCAC). **No readings exceeded the guideline. However, the two highest samples occurred during two of the four highest ammonia concentrations. The Chlorophyll a readings averaged 6.7 µg/L.**

Temperature

Sullivan et al.⁴ state that the maximum weekly average temperatures for protection of steelhead or rainbow trout, and coho salmon are 19.6 and 19.7°C, respectively. **The temperature averaged 16.0°C and ranged from 8.8 to 25.7°C. Though weekly averages were not taken, the temperatures taken at this site indicate averages that may regularly exceed the maximum temperatures for fish protection.**

³ Mesa, M.G., L.K. Weiland, & A.G. Maule. (2000). *Progression and severity of gas bubble trauma in juvenile salmonids*. Transactions of the American Fisheries Society. 129:174-185.

⁴ Sullivan, K., D.J. Martin, R.D. Cardwell, T.E. Toll, & S. Duke. (2000). *An analysis of the effects of temperature on salmonids of the Pacific Northwest with implications for selecting temperature criteria*. Portland, OR: Sustainable Ecosystems Institute.

Summary of Toxicity Data

Species with Significant Mortality

	Feb-05	Mar-05	Apr-05	Jul-05	Sep-05	Feb-06	May-06	Aug-06	Sep-06	Feb-07	Mar-07	Apr-07	Oct-07
Invertebrate (Water Column)	Yes	Yes		No	No*	No		No	No	No	Yes		No
Invertebrate (Sediment)			Yes				Yes					Yes	
Fish (Water Column)	Yes	Yes				No		No	No	No	No		No*
Algae (Water Column)	No	No				No		No	No	No	No		No

*Indicates significant effect on growth or reproduction (even though mortality did not have a significant effect)

Significant effect is determined by statistically significant rates of mortality, growth, or reproduction compared to a control sample and provides an indication that something is affecting plant or animal life in the stream. Invertebrates show significant sensitivity to organophosphates and pesticides. Significant effect to algae often indicates the presence of herbicides and metals such as copper. Fish are less sensitive to organophosphates but can be impacted by other pollutants such as ammonia and pyrethroid pesticides.

Photos of Site



February 2006



July 2006

QAQC

The data in this water quality monitoring fact sheets meet the quality assurance and quality control requirements of the Water Board's Surface Water Ambient Monitoring Program (SWAMP). Additional surface water monitoring data are available at the Water Board's Central Coast Ambient Monitoring Program website <http://www.ccamp.org>. Any questions regarding the data or analysis should be directed to either **Peter Meertens** at pmeertens@waterboards.ca.gov (805) 549-3869 or **Amanda Bern** at abern@waterboards.ca.gov (805) 594-6197.

Attachment: Monitoring Data

SiteTag	Merrit Ditch upstream from Highway 183													
309 MER	Beneficial Uses: Not Specified													
		Ammonia as N, Unionized	Chlorophyll a	Conductivity	Instantaneous Flow	Nitrate/Nitrite as N	N / STD	Orthophosphate as P	OP / STD	Oxygen, Dissolved	Oxygen, Saturation	pH	Turbidity	Water Temp
Units		mg/L	µg/L	mmho/cm	CFS	mg/L	none	mg/L	none	mg/L	%		NTU	°C
1/26/2005	Jan-05	0.0059	7.99	1.520	3.9	18.2	1.82	0.34	2.8	7.85	76	7.55	376.4	13.2
2/16/2005	Feb-05			0.621						8.69	83	7.36	978.9	13.4
2/22/2005	Feb-05	0.0125	7.44	1.170	45.0			0.375	3.1	8.18	77	7.48	316.6	12.2
3/21/2005	Mar-05	0.0069	7.63	1.261	35.6			0.47	3.9	7.98	82	7.87	240.4	17.1
4/12/2005	Apr-05	0.0033	10.94	1.989	0.6			0.22	1.8	12.97	150	8.13	367	22.5
5/24/2005	May-05	0.0125	1.31	1.794	0.4			0.36	3.0	17.57	202	8.86	42.3	22.0
6/28/2005	Jun-05	0.0125	11.6	2.327	0.4	21	2.1	0.121	1.0	7.8	85	8.29	41.8	19.3
7/26/2005	Jul-05	0.0125	2.09	2.328	0.3			0.0038	0.0	9.25	105	8.21	32.6	21.2
8/30/2005	Aug-05	0.084	36.14	2.213	0.4			0.446	3.7	11.09	118	8.46	85.7	17.9
9/27/2005	Sep-05	0.0184	5.46	2.997	0.3			0.205	1.7	8.9	94	8.24	106.7	17.6
10/25/2005	Oct-05	0.0074	6.79	3.217	6.4			0.322	2.7	8.01	81	7.88	43.2	15.9
11/29/2005	Nov-05	0.0036	4.54	2.641	3.2			0.229	1.9	7.96	72	7.97	62.7	10.8
12/13/2005	Dec-05	0.004	5.47	1.990	0.0			0.206	1.7	8.28	74	7.91	56.7	10.1
1/24/2006	Jan-06	0.0044	1.54	1.838	0.0	27.8	2.8	0.23	1.9	10.81	94	7.85	87.6	8.8
2/22/2006	Feb-06	0.0039	22.11	2.295	0.7	35.2	3.5	0.339	2.8	7.38	69	7.92	942	12.5
3/29/2006	Mar-06	0.0025	6.85	0.954	2.4	6.52	0.7	0.207	1.7	7.25	67	7.87	248.5	11.6
4/25/2006	Apr-06	0.1052	3.4	1.444	1.1	12.9	1.3	0.6026	5.0	6.82	69	7.83	162.7	15.5
5/24/2006	May-06	0.0115	1.72	1.079	1.2	6	0.6	0.263	2.2	4.79	55	7.78	107.2	23.0
6/27/2006	Jun-06	0.0105	9.25	2.008	3.4	15.6	1.6	0.025	0.2	8.62	96	8.59	9.1	20.2
7/25/2006	Jul-06	0.0047	4.39	2.165	2.4	5.29	0.5	0.322	2.7	3.91	43	8.22	29.5	19.7
8/23/2006	Aug-06	0.0125	3.86	2.291	5.1	18	1.8	0.17	1.4	6.16	67	7.95	22.6	19.4
9/27/2006	Sep-06	0.0081	7.96	1.935	2.1	7.68	0.8	0.36	3.0	4.73	49	7.99	9.1	16.9
10/24/2006	Oct-06	0.0508	1.29	1.761	3.0	64.8	6.5	0.204	1.7	5.89	57	8.36	108.4	13.2
11/14/2006	Nov-06	0.0066	3.78	2.071	19.9	38.3	3.8	0.3739	3.1	5.04	50	7.67	73	14.7
12/12/2006	Dec-06	0.0032	5.59	1.106	3.1	17.1	1.7	0.2765	2.3	6.95	61	7.76	362.6	10.3
1/30/2007	Jan-07	0.0014	0.64	1.870	6.8	28.8	2.9	0.1383	1.2	7.13	65	7.74	73.9	10.8
2/14/2007	Feb-07	0.0149	2	1.621	7.4	16.3	1.6	0.1495	1.2	6.14	62	8.00	116.3	16.2
3/21/2007	Mar-07	0.0061	1.43	3.179	1.8	27.2	2.7	0.3706	3.1	8.95	87	8.13	48.8	13.5
4/4/2007	Apr-07	0.3194	4.32	4.183	0.5	25.6	2.6	0.3531	2.9	14.45	166	8.58	875	21.1
5/29/2007	May-07	0.0753	30.92	2.129	6.7	10.2	1.0	0.0038	0.0	19.54	203	9.07	178.2	16.8
6/26/2007	Jun-07	0.0101	3.87	2.008	0.7	5.25	0.5	0.0038	0.0	5.23	52	8.34	74.6	14.7
7/23/2007	Jul-07	0.0032	8.19	2.593	1.2	15.5	1.6	0.0038	0.0	16.46	203	8.47	50	25.7
8/28/2007	Aug-07	0.0316	2.72	2.246	0.5	3.52	0.4	0.0921	0.8	9.69	112	8.44	19.2	21.8
9/25/2007	Sep-07	0.0112	1.81	1.880	0.7	22.1	2.2	0.2208	1.8	12.23	138	8.13	88.5	21.4
10/23/2007	Oct-07	0.0046	2.63	1.804	0.0	15.4	1.5	0.2921	2.4	8.44	82	8.00	315.6	14.2
11/27/2007	Nov-07	0.0032	1.58	2.334	0.0	23.6	2.4	0.2551	2.1	11.81	102	7.97	189.1	9.2
12/16/2007	Dec-07	0.0059	2.01	2.004	1.1	18.2	1.8	0.2092	1.7	9.95	87	7.92	396.8	9.4
Average		0.025	6.7	2.02	4.7	19.5		0.24		9.0	Below	8.1	198	16.0
Standard Deviation		0.056	7.8	0.68	9.6	13.1		0.14		3.6		0.4	250	4.5
Minimum		0.001	0.6	0.62	0.0	3.5		0.00		3.9	43	7.4	9	8.8
Maximum		0.319	36.1	4.18	45.0	64.8		0.60		19.5	203	9.1	979	25.7
Standard		<0.025	<40	<0.75		<10		<0.12		>5		7-8.5	<25	
%Outside		17%	0%	3%		77%		83%		8%		11%	89%	
Standard 2				>3						>7		7-8.3		
%Outside				11%	Median Annual DO %					27%		24%		
					Year	Median	Meet Criteria							
					2005	83%	No							
					2006	64%	No							
indicates times exceeding standard					2007	95%	Yes							